

**Expansion velocities of solid density plasmas produced by
intense ultrashort laser pulses[†]**

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Abstract: We report spatially and temporally localized measurements of 500 eV electron temperatures in solid density Al plasmas generated by a $3 \times 10^{17} \text{ W/cm}^2$, 170 fs laser. The plasmas studied here were produced at the Ultra Short Pulse (USP) laser facility at LLNL. Expansion velocities of marker layers from various depths are sampled with mass resolved ion time-of-flight spectroscopy¹ along the central axis of the expansion. These ions are subject only to the spatial peak of the laser intensity profile, thus providing spatial localization. Hydrodynamic simulations relate the measured velocities to the peak sound speed, determining the peak temperature along the central axis of the plasma. Results are consistent with conductive heating of the first 1000 Å. We believe these to be the first spatially and temporally localized measurements of electron temperature in solid density plasmas. In other experiments @ 10^{19} W/cm^2 incident upon 500 Å Al foils, we observe protons with energy up to 2 MeV. These observations will be compared with PIC simulations.

1. G. Guethlein, RSI **66** (1), 333 (1995).

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